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NOTICE INFORMING THE APPLICANT OF THE
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(PCT Rule 47.1(c), first sentence)

To:

MAIN, Richard, B.
Main Law Firm
47000 Warm Springs Blvd.
Suite 427
Fremont, CA 94539
ÉTATS-UNIS D'AMÉRIQUE

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IMPORTANT NOTICE

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Applicant:

SERVER TECHNOLOGY, INC. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

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2. In accordance with Rule 47.1(c), third sentence, each designated Office will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Offices.
3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 27 May 1993 (27.05.93) under No. WO 93/10615

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If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

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34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorised officer:

J. Zahra

Telephone No.: (41-22) 730.91.11

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF
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Date of mailing: 27 May 1993 (27.05.93)	IMPORTANT NOTICE
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has (have) waived the requirement for such a communication, but nevertheless a copy of the international application need not be furnished by the applicant to the Office(s) concerned.

Although the United States of America has been designated in the international application, the international application was not communicated to the United States Patent and Trademark Office since that Office was the receiving Office of the said application and has waived the requirement of communication provided for in Article 20 for all international applications for which it is the receiving Office. Since, however, that Office requires the applicant to furnish it with a copy of any amendments and any statement made under Article 19, a copy of such amendments and statement (if any) is being sent herewith to the applicant for transmittal, by the applicant, to the said Office (see Rule 47.1(e)).

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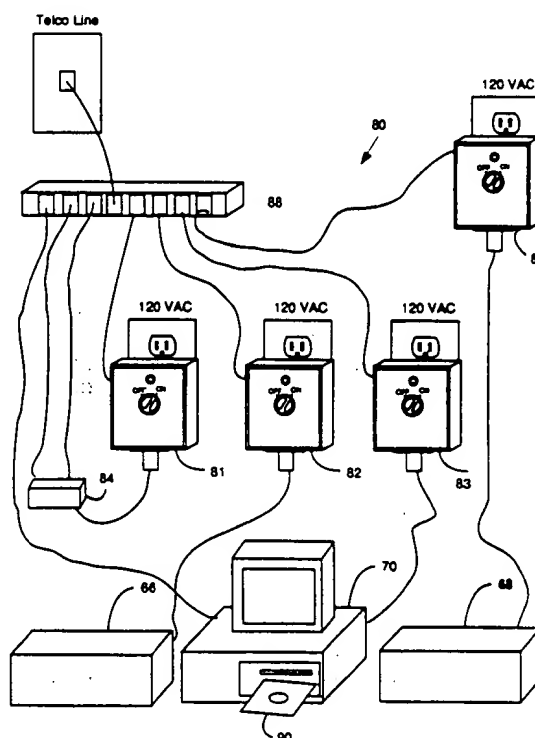
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(54) Title: SYSTEM FOR PROTECTING AND RESTARTING COMPUTERS AND PERIPHERALS AT REMOTE SITES WHICH ARE ACCESSIBLE BY TELEPHONE COMMUNICATION

(57) Abstract

An embodiment of the present invention comprises an intelligent power module (IPM) (81-84), a desktop on/off switch, a serial and parallel adapter, and a computer-implemented process on a diskette (90). The intelligent power module (81-84) has an electrical power input and an output to supply power via a user activated manual switch or programmatically using computer instructions to a surge outlet strip or general office equipment (66, 68). It further comprises control circuits (88) which can interpret remote instructions to the IPM to control the flow of AC power to unattended office equipment (66, 68). The IPM (81-84) can be remotely controlled by a user activated manual switch or by the computer (70) itself.



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SYSTEM FOR PROTECTING AND RESTARTING COMPUTERS AND
PERIPHERALS AT REMOTE SITES WHICH ARE ACCESSIBLE BY
TELEPHONE COMMUNICATION

5

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates generally to computers and
10 more particularly to remote control methods and devices
to protect computer systems from various threats and to
remotely reset a system that has become hung.

15 Description of the Prior Art

Electrical power conservation, fire hazard, hackers
who rove randomly on the telephone, lightning storms,
and other concerns are such that it makes good sense to
turn off a personal computer system for the night, the
20 weekend, or any other time it will be left unattended.
But a computer system that has been powered down, or
worse, one that has crashed all by itself, cannot
respond to any phone calls that may come over an
attached modem.

25 Modems have become a common and popular way for
workers to communicate via their computers. Work can be
shared, submitted, edited, and published, all via
computer modem. Automated systems use modems too for
various kinds of networks and bulletin boards.

30 Various kinds of remote controlled power switches
have appeared on the personal computer (PC) after
market. One such device is a telephone activated power
control unit marketed in the United States as POWER-ON
by Server Technology (Santa Clara, CA). It allows a PC,
35 using a standard telephone line and modem, to power-on a
remote PC. Using bundled communications software the PC

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can operate the remote PC, run its programs, transfer data files, and use a printer.

United States Patent 4,647,721, issued to Busam, et al., describes a telephone activated power controller
5 having an electrical power inlet and a number of outlets for various appliances, such as a computer. A detector senses a ring condition on a standard telephone line and goes off-hook while connecting inlet power to its outlets. A remote control unit allows the computer to
10 keep the power on after hang-up (on-hook) or manual power-off. A status sensor can tell the computer if the device has been turned on manually or remotely. An inhibit circuit can prevent the device from responding to a telephone ring or off-hook condition. The
15 controller also has surge protection on the power outlets.

A device called POWERKEY is being marketed for the Apple Macintosh PC. This device reportedly can turn a system on and off, and it can execute keyboard macros at
20 present times, for applications such as unattended backups or telecommunications file transfers. A "cdev" program enables daily, weekday, weekly, monthly, and unique events to be scheduled. The Macintosh can be turned on with a phone call using a POWERKEY remote
25 device. Software such as TIMBUKTU REMOTE or CARBON COPY MAC can allow the computer to be operated from a remote location as if the operator were actually in front of the computer, and not one connected to it.

Another device called PHONEBOOT is sold by Cybex
30 Corporation (Huntsville, Alabama) allows a user to boot computers, peripherals, and other appliances from a remote location using a telephone, while providing built-in password protection. The device has six 120 VAC outlets, surge protection, a phone plug, a modem
35 plug, and a power cord. It works with Hayes compatible modems and TOUCH TONE (DTMF) telephones. There are

three modes of operation: remote enable, local on, and master off. In remote enable, the device monitors an incoming phone line for a call. After eight rings, the call is answered and the caller is given a prompt tone and a three digit security code must be entered. The code can come in via TOUCH TONE phone or by modem. If the code is accepted, the power outlets are turned on. If a modem is attached, it must provide an answer back tone to the caller and establish a communications channel. Power is left on for 18 minutes after hanging up.

Yet another device is the TELESWITCH by EKD (Selden, NY) which uses a four digit security code, a local ring circuit for a modem after power-up, and automatic modem transfer to phone line after modem answers local ring. It is advertised to work with host/remote software such as pcANYWHERE (Dynamic Microprocessor Associates). The device allows a user to disconnect during a call to save on phone charges while leaving the computer on. A later call-back can shut the power down.

Other units with more-or-less the same features described above are the "Remote PowerOnOff Control" by L-Tech Associates (Oak Lawn, IL), the INTELE-STRIP 800 from ALM (California), and the Lead Operated Relay (LOR-II) GS-SW701A by Black Box Catalog.

The prior art is generally best described by the words clumsy and expensive. They lack flexibility and are invariably implemented with fixed, hard-to-change discrete logic. New features are hard to add and complex features are impossible to implement. An improved system is needed for the PC user that is expandable and inexpensive to acquire. Such a system should offer higher levels of security, individual control of multiple devices, and an ability to perform

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controlled reboot operation of remote systems via a modem communications interface.

5

SUMMARY OF THE PRESENT INVENTION

It is therefore an object of the present invention to provide an intelligent response control unit that can validate a password before powering on the host computer.

10

It is a further object of the present invention to provide a system that can control several independent power outlets.

It is a further object of the present invention to provide a system that can manage a controlled reboot operation to clear error (hung) conditions on servers, remote bridges, and unattended office equipment.

Briefly, an embodiment of the present invention comprises an intelligent power module (IPM), a desktop on/off switch, a serial and parallel adapter, and a computer-implemented process on a diskette. The intelligent power module has an electrical power input and an output to supply power via a user activated manual switch or programmatically using computer instructions to a surge outlet strip or general office equipment. It further comprises control circuits which can interpret remote instructions to the IPM to control the flow of AC power to unattended office equipment. The IPM can be remotely controlled by a user activated manual switch or by the computer itself.

An advantage of the present invention is that an embodiment can be constructed so that personal computers do not have to run 24-hours a day to be available 24-hours a day.

Another advantage is that maintenance and operating costs can be significantly reduced.

These and many other objects and advantages of the present invention will no doubt become obvious to those of ordinary skill in the art after having read the following detailed description of the preferred
5 embodiments which are illustrated in the various drawing figures.

IN THE DRAWINGS

10

Fig. 1 is a diagram of a first embodiment of a power management system according to the present invention;

15 Fig. 2 is a diagram of a second embodiment of a power management system according to the present invention;

Fig. 3 is a diagram of a third embodiment of a power management system according to the present invention;

20 Fig. 4 is a simplified schematic diagram of RCU 100;

Fig. 5 is a schematic diagram of RCU 56;

25 Fig. 6 is a schematic of a power control module that has a single control input and uses a triac for transfer relay control;

Fig. 7 is a schematic of a power control module that has a dual-input control and uses an SCR for transfer relay control;

30 Figs. 8(a) through 8(e) are mechanical elevations of a way to package a power control module. Fig. 8(a) is a top view. Fig. 8(b) is a left side view. Fig. 8(c) is a right side view. And, Figs. 8(d) and 8(e) are side views of opposite ends; and

35 Figs. 9(a) through 9(c) show the three major assemblies of a power control module like that in Figs. 8(a) through 8(e) before assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Fig. 1, a power management system 10, according to a first embodiment of the present invention, comprises an intelligent power module (IPM) 12 (shown plugged into a wall outlet), a desktop on/off switch 14, a serial and parallel adapter 16 with a control cable 18, and a computer-implemented process on a diskette 20. IPM 12 has an electrical power input and an output to supply power via a user activated manual switch or programmatically using computer instructions to a surge outlet strip or general office equipment. The IPM 12 further comprises control circuits which can interpret remote instructions to the IPM 12 from computer 24 to control the flow of AC power to unattended office equipment. The IPM can be remotely controlled by a user activated manual switch 22 or by a computer 24 itself. Appliances 26 and 28, along with computer 24, are powered by a plug strip 30 connected to IPM 12. System 10 is able to turn the power off to plug strip 30 after running a job on computer 24 by sending an appropriate signal out adaptor 16 to IPM 12.

In Fig. 2, a power management system 50, according to a second embodiment of the present invention, comprises a remote power module (RPM) 52 (shown plugged into a wall outlet), an external modem 54, a modem cable 56, a response control unit (RCU) 58, a computer-implemented process on a diskette 60. RPM 52 has an electrical power input and an output to supply power via a user activated manual switch 62 or programmatically using computer instructions to a surge outlet strip 64 and general office equipment 66 and 68, and also a computer 70. The RPM 52 further comprises control circuits which can interpret remote instructions to the RPM 52 to control the flow of AC power to unattended office equipment. The RPM 52 can be remotely controlled

by computer 70 or a calling computer via RCU 58. RCU 58 has three RJ-11 jacks to receive standard modular cord plugs from the telephone line (Telco), modem 54, and one RPM 52.

5 In Fig. 3, a power management system 80, according to a third embodiment of the present invention, comprises first through fourth remote power modules (RPMs) 81-84 (shown plugged into separate wall outlets), an external modem 85, a modem cable 86, a response
10 control unit (RCU) 88, a computer-implemented process on a diskette 90. RPMs 81-84 each have an electrical power input and an output, and are similar to RPM 52 (Fig. 2). RCU 88 has eight RJ-11 jacks to receive standard modular
15 cord plugs from the telephone line (Telco), modem 85, and four RPMs 81-84, and two carrying RS-232 channels, one to modem 85 and one to computer 70. RPMs 81-84 can be individually and independently controlled from RCU 88.

A simplified schematic for RCU 88 is shown in Fig.
20 4. A pair of serial RS-232 interfaces 91 and 92 couple to modem 85 and computer 70, respectively, and are level shifted with RS-232 buffers, for example using Motorola MC145406 and MC145407 buffers. The intelligence of RCU 88 is provide by an Intel 8032 ROM-less type
25 microcontroller 93 and a firmware program 94 (not shown due to its nature) stored in a 27C256 EPROM 95. A type 74C22106 addressable latch/data selector 96 provides bit control for modem command and status lines, such as RTS, DCD, etc. An Intel type microcontroller is used,
30 because compared to similar devices from competing manufacturers, the 8032 has more and better development tools available and programmers familiar with it are easier to locate. Firmware program 94 is computer-implemented process that operates RCU 88 according the
35 the function description below. A type 74HCT373 octal buffer 97 provides the drive necessary from the data bus

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(port P00-P07 of the 8032 microcontroller) to drive four switch status LEDs and, with the aid of a type 74LS05 open-collector inverter, drive four RJ-11 jacks PCM1-PCM4, e.g. coupled to RPMs 81-84. The tip and ring from a Telco RJ-11 jack 98 are input to a CD22204E DTMF unit 99 which is clocked by a 3.58 MHz crystal. A type TLP621-2 opto-isolator 100 is connected to tip and ring provide off-hook indication to the 8032 microcontroller. A ring detection circuit 101 comprises a type TLP621-2 opto-isolator and a type TCM1520A ring detector. Circuit 101 provides ring indication to the 8032 microcontroller. Tip and ring from the Telco RJ-11 jack 98 are simply passed through to the tip and ring of a RJ-11 jack 102, e.g. for connection to modem 85. A non-volatile memory 103 is used to store user settings. A set of four manual pushbutton switches 104 sensed by a computer-implemented process can be used to individually control from one to four power modules.

In Fig. 5, RCU 58 comprises an EPROM-based 8-bit CMOS microcontroller 110, preferably a Microchip Technology PIC16C54, with a six pole DIP switch 111 connected to six pins on I/O port "B". The tip and ring from a Telco RJ-11 jack 112 are input to a type TLP621-2 opto-isolator 113 to provide an off-hook indication to the 8032 microcontroller. A ring detection circuit 114 comprises a type TLP621-2 opto-isolator and a type TCM1520A ring detector. Circuit 114 provides ring indication to the PIC16C54 microcontroller 110. Tip and ring from Telco RJ-11 jack 112 are simply passed through to the tip and ring of another RJ-11 jack 115, e.g. to couple to modem 54. Port RA0 is used to read the condition of a switch 116. Ports RA1 and RA2 drive two status LEDs 117 and 118 via type 74LS05 open-collector inverters. A single power controller module 119 is driven by port RA3 via another type 74LS05 open-collector inverter.

System 80, for example, requires the ability to intercept the RS-232 line between modem 85 and computer 70. Most signals from modem 85 are passed directly through RCU 88 without change, but at a minimum the RCU 88 must be able to freely use the XMT and receive lines to modem 85 without interference from computer 70. Interception of the data terminal ready (DTR) line is also preferred. As is support for sensing, as practical, CD, RI, and DSR.

10 Computer 70 should be able to interact with modem 85, as if the RCU 88 was not present. Choices for RS-232 DCE/DTE connectors (male/female type assignment is open) can include, but are not limited to:

DB-25: No "missing" pins/signals. Cables are readily available. The connectors would use up much of the available case end-plate real estate. Also, high cost;

DE-9: All standard RS-232 pins/signals (transmit, receive, RTS, CTS, DTR, DSR, CD, RI and GND are supported, and standard IBM "AT" pin-out cables are generally available. Not a large impact on panel space, but the PCB connectors are generally expensive;

25 Mini-DIN 9: Same signals as DE-9, but cables have to be custom manufactured (for both DCE and DTE devices); and

Mini-DIN 8: One RS-232 signal has to be dropped (e.g., RI, CD, or DSR). Custom cables have to be made.

RCU 88 preferably has the ability to interact with a caller intelligently (either by RS-232 or by DTMF codes), to require from the caller a password, device code, and command, at a minimum. This requirement is preferably satisfied by microprocessor control.

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RCU 88 should generate an external control signal that can be used to control power to computer 70. As many as three additional (similar) external control signals (ports) are preferred. Each port should have an attendant "manual" switch and "true" LED indicator. These switches and LEDs can be microprocessor peripherals.

For security, RCU 88 preferably allows a user to set a "password" code. An eight position DIP switch can satisfy this requirement. As many as four option switches may also be required. A status/heartbeat/system alive-and-well indicator is preferred. A single "status" LED would be sufficient. An ability to "attach" to a user's phone line to do both ring and off-hook detection, as well as being able to receive DTMF signals. The signals for each must be available to the microprocessor. When an option is not installed, the microprocessor must be presented with an false signal. (If the microprocessor sends DTMF, it can do so through modem 85.) Certain DTMF decoders may require their own crystal.

If a two-way power line interface is used, a standard telephone jack on the case should be coupled to the microprocessor. This also requires the user to set a house code for RCU 88. A four-pole DIP switch has enough bits to set a valid house code.

Microprocessor Considerations--Support for standard data rates usually requires an 11.0592 MHz crystal. Switch debouncing for manual "power" switches should be done by firmware. When an external ROM is used, microprocessor I/O pins are in short supply, so addressable tri-state buffers are needed for switch/device inputs that don't have tri-state capability, and addressable latches are needed for the LEDs, external power controls and for controlling the interception of RS-232 signals.

Firmware Functions

Although described here as firmware functions, the following actions required of the system can be

5 implemented by discrete hardware logic, instead of as computer-implemented processes, albeit not as readily. The programmability of microcomputers makes their choice in the implementation of the following hard to resist.

At power-on, microcontroller 93, under control of
10 firmware program 94, initializes, verifies its control program, makes false all external power controls, configures its RS-232 intercept in such a way that computer 70 has "control" of any attached modem 85 via interface 91, takes inventory of optional features, and,
15 if all is well, starts flashing its status LED at a regular interval. If any faults are detected, firmware program 94 flash the status LED in a distinctive manner and indicates the failure type on the "power control" LEDs connected to latch 97.

20 Under the assumption that power control for computer 70 might not be done through firmware program 94, the outbound DTR line from computer 70 is checked to determine if computer 70 is powered on, and has an active serial port.

25 If DTR is true, and passive mode inhibit is not true, firmware program 94 will not query modem 85 and will not attempt to issue modem 85 commands to answer any incoming calls. Computer 70 to modem 85 link will be kept, and is firmware program 94 passive mode.

30 Otherwise, firmware program 94 sets an RS-232 intercept control to allow direct communication with modem 85. After modem 85 communications have been established, firmware program 94 commands modem 85 to not auto-answer, and requests that modem 85 go on-hook. firmware
35 program 94 then monitors the modem line to detect

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incoming calls, and it monitors the DTR line from the computer for activity. This is the active mode.

In interactive, true, passive, and idle modes, firmware program 94 preferably always monitors the power control switches. If one of these switches should become true, firmware program 94 sets its corresponding control line and LED true. If an true switch goes false, firmware program 94 turns off the corresponding control line and LED. All switch actions are subject to debouncing, with a 0.25 second threshold.

If, while in active mode, firmware program 94 senses that the serial port of computer 70 has come alive (e.g., DTR true), and a passive inhibit is not true, firmware program 94 releases control of modem 85 and set its RS-232 intercept to give computer 70 control of modem 85, and then goes into passive mode.

While if in passive mode firmware program 94 senses that the serial port of computer 70 is no longer true (DTR false) for a period of at least three seconds, or passive inhibit becomes true, firmware program 94 will take control of modem 85 and go into the active mode, in which modem 85 informs firmware program 94 that a ring has occurred, firmware program 94 will start its command mode.

In command mode, firmware program 94 commands modem 85 to take the phone line off-hook. If DTMF support is enabled, modem 85 will not be required to establish a carrier. Rather, firmware program 94 waits up to 30 seconds for a DTMF password to be received by DTMF device 99. If either an invalid password is given or no DTMF code is received, firmware program 94 has modem 85 return to the on-hook state via command on serial interface 91. If the password is valid, firmware program 94 waits up to 30 seconds for a line-code or command sequence. If DTMF support is not enabled, modem 85 will be required to establish a carrier, after which firmware

program 94 stores a connection message from modem 85. It forwards the message to computer 70 later (when and if the caller asks to be put through to computer 70). firmware program 94 then communicates via modem 85 directly with the caller (see below for exemplary scripts) to obtain a "password" code. Again, all communications are constrained by a 30 second no-response/hang-up timeout. If the password is invalid, hang-up is immediate.

10 On a valid password, firmware program 94 requests a line-code/command sequence from the caller. Once firmware program 94 has a valid line-code/command sequence, and any preliminaries have been completed (e.g., power on/off), the sequence will be acknowledged.

15 In the case of DTMF, a single pulse indicates a good sequence and a multiple pulse (with a pause between each pulse) indicates a failed sequence. If an error occurs after a valid password, the caller is given the chance to try again. With a valid line-code/command having

20 been received, firmware program 94 executes the request. For simple on/off commands, once the commanded action is completed, the caller is informed of a valid command (as noted above) and the phone line is placed back on-hook (LEDs will be updated, if needed, blinking on started or

25 constant off). If the caller requested to use computer 70, it is turned on. Firmware program 94 waits for computer 70 DTR line to go true. If the call was a DTMF call, modem 85 is required to establish a carrier. Computer 70 either has an already true CD or one that

30 will be ready. If the call is a non-DTMF call, firmware program 94 transfers its RS-232 lines from modem 85 to computer 70 and sends computer 70 the modem's previously captured connect string. Then firmware program 94 ties the modem's RS-232 lines to the lines on computer 70.

35 Firmware program 94 then goes into an idle mode.

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While in idle mode, any action is based on the last true computer 70 oriented command received. firmware program 94 may wait for a call to complete, and then computer 70 power off immediately, or off after a preset number of seconds. In either case, it returns to active mode. Another possibility is that when the call completes, based on a prior command, firmware program 94 enters passive mode.

Passive mode can be inhibited by an option switch control. If passive mode is inhibited, computer 70 will only be connected to modem 85 after either a specific command from a caller or after a special "break" command sequence from computer 70 (see below). The passive mode inhibit switch is read by firmware program 94 dynamically, allowing a user to regain control of modem 85 at any time by changing the switch on firmware program 94.

Firmware and/or hardware means to allow computer 70 to communicate directly with firmware program 94 are needed. Computer 70 should be able to get attention from firmware program 94 directly. A break signal sent by computer 70 while modem 85 is "false" causes firmware program 94 to turn its attention solely to computer 70 and enter an interactive mode. Until computer 70 releases control, firmware program 94 will not process modem 85 information. firmware program 94 can determine that modem 85 is inactive in the following ways:

when a CD line driver is provided, firmware program 94 can simply give computer 70 a direct line to firmware program 94 on a break signal. But RS-232 line drivers may be in short supply. Additional MC145406 devices, for example, may be needed or discrete digital logic added to interface the CD signal on modem 85 to firmware program 94;

when either the on-hook/off-hook means or its DTMF chip equivalent are included with firmware program 94, then firmware program 94 can use the current on-hook state to qualify a break
5 signal; and
if computer 70 is allowed to gain direct control of firmware program 94, when it is in active mode and its passive inhibit switch is true, then a break signal can be qualified by an internally
10 monitored on/off-hook state.

A default (power-on) data rate is preferably predetermined in advance, e.g., 9600 bps. The data rate should be changeable by computer 70 on request (using
15 the data rate then in effect). firmware program 94 will return to its default setting whenever power is cycled. If a "fixed" data rate is an unreasonable constraint, other alternatives may be needed to solve to the problem of getting an initial communication between computer 70
20 to firmware program 94 started.

If ring/off-hook detection circuits are used and the auto-power-up switch is true, firmware program 94 will activate the power control line to computer 70 as soon as ring detect goes true, it is deactivated
25 whenever the phone line stays on-hook continuously for at least 2 minutes. Any call received prior to the time-out will reset the logic. When the auto-power-up switch is true, firmware program 94 makes no attempt to communicate with the caller. In this mode, firmware
30 program 94 is little more than a simple switch that is ring-activated and on-hook deactivated. No RS-232 connections are required for this mode.

The caller to computer 70 operator to modem 85 to firmware program 94 interactions fall into three types,
35 remote caller interface, direct computer 70 to firmware

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program 94 interface, and firmware program 94 to modem 85 interface.

Remote Caller Interface

- 5 1) Caller starts a communications program
 which sets a valid data rate with 8N1 and
 dials an idle modem 85 with an attached
 RCU 88;
- 2) modem 85 sends "ring" message to RCU 88;
- 10 3) RCU 88 sends off-hook & answer command to
 modem 85;
- 4) modem 85 establishes carrier and send
 connect message to RCU 88;
- 5) RCU 88 interprets the connect message and
15 sets it data rate accordingly;
- 6) at the current data rate and SN1 RCU 88
 sends the following message to the
 caller:
- 20 *Welcome, please enter your password: ; and*
- 7) With no echo, but allowing for character
 deletion, RCU 88 inputs a password code,
 followed by a return. RCU 88 then
25 verifies the password.

If the password is not valid, RCU 88 issues a modem 85 hang-up sequence by lowering DTR and checking for either on-hook or no carrier, if that fails RCU 88 tries
30 pause, "+++", pause, and looks for "OK" from modem 85, then sends "ATH0" and again checks for either on-hook or no carrier. If that fails, it keeps trying.

If the password is valid, RCU 88 sends the following message:

35 *Line code (1-4, or 0 to hang-up):*

If the user doesn't enter a valid digit, RCU 88 responds:

5 Please enter a valid digit code.
 Line code (1-4, or 0 to hang-up):

On any valid choice RCU 88 then responds:

10 Command code (1-9, or 0 to hang-up):

If the user doesn't enter a digit, RCU 88 responds:

15 Please enter a valid digit code.
 Command code (1-9, or 0 to hang-up):

On any valid choice RCU 88 responds:

Command complete.

RCU 88 then returns to the "Line code" prompt. If at any time the caller chooses "0", RCU 88 hangs up as described above (for invalid password).

25 Direct computer 70 to RCU 88 Interface

Computer 70 user starts a communications program and sets the data line to 9600 8N1. ("8N1 represents a communications byte with eight data bits, no parity, and one stop bit.) A user ascertains that modem 85 is not on-line (off-hook false, No CD). The user then sends a "break" signal on the serial output from computer 70 and RCU 88 responds:

Command (? gives help):

35

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- a) If user types a "?" followed by a return,
RCU 88 responds:

Commands are:

5

B	Set data rate
H	Set X-10 house code
M	Connect computer to modem
R	Resume normal operation
X	Issue an X-10 command

10

(N/A)

Command (? gives help):

- b) If user types any letter other than those
listed above, RCU 88 acts as if the user
typed a "?" (the user can backspace).

15

- c) For "B" and return, RCU 88 responds:

20

Choose new data rate:

A	19200 8N1
B	9600 8N1
C	4800 8N1
D	2400 8N1
E	1200 8N1
F	300 8N1
X	Keep current setting

25

Enter choice (A-F or x to leave):

- 30 If the user doesn't enter one of the preceding letters,
RCU 88 responds:

Please choose one of the given options.

Enter choice (A-F or x to leave):

35

On any valid choice, RCU 88 responds:

New data rate selected.

Press "return" when your terminal is set at the new data rate.

5 <Waiting for return at new data rate>

When the user enters a "return" at the new data rate, RCU 88 returns to the "Command" prompt.

10 d) For "H" and return, RCU 88 responds:

Enter house code (0-9, A-F, X to leave):

If the user doesn't enter a digit or a letter A through

15 F or an X, RCU 88 responds:

Please choose one of the given options.

Enter house code (0-9, A-F, X to leave):

20 On any valid choice RCU 88 responds:

House code has been set.

RCU 88 then returns to the "Command" prompt.

25

e) For "M" and return, RCU 88 responds:

Ready to connect computer to modem.

Enter "Y" to connect (X to leave)

30

If the user doesn't enter either "Y" or "X", RCU 88 responds:

Enter "Y" to connect (X to leave):

35

If the user enters "Y", RCU 88 responds:

-20-

When this message ends you will be connected to modem.

*To return to the "Command" prompt,
send "Break" with modem Off-Line.*

5 *End of Message.*

At which point RCU 88 connects the user's computer 70
"directly" to modem 85.

10 f) For "R" and return, RCU 88 responds:

*Ready to monitor modem for calls.
Enter "Y" to continue (X to leave):*

15 If the user doesn't enter either "Y" or "X", RCU 88
responds:

Enter "Y" to connect (X to leave):

20 If the user enters "Y", RCU 88 responds:

*To return to the "Command" prompt,
send "Break" with modem Off-Line.
Resuming normal operations.*

25

At which point RCU 88 disconnects from computer 70 and
continues monitoring modem 85/Phone line.

g) For "X" and return, RCU 88 responds:

30

X-10 Command interface - Not Implemented.

RCU 88 then returns to the command prompt.

35 Power Control Modules

Fig. 6 represents a power control module 120 that has a single control input 122 and uses a triac 124 to control a transfer relay 126. When input 122 receives a signal, an opto-isolator 128 will trigger triac 124 to turn-on, which also activates transfer relay 126 and an associated switch 130. When power is switched through to the output of module 120, an LED 132 will be lit.

One power control module 120 can be used in system 50 to serve as RPM 52, or four in system 80 as RPMs 81-84.

10 In Fig. 7, a 120 VAC power control module 140 comprises dual-input control lines 142 and 144, a fuse 146, four rectifiers 147-150 in a full-wave bridge, a transfer relay 152, a capacitor 154, an SCR 156, an opto-isolator 158, an on/off switch 160, and an LED 162. 15 As can be seen in a comparison with the schematic of Fig. 6, module 140 is more complex than module 100, mainly because an SCR is used, instead of a triac. Input lines 142 and 144 are diode isolated and effectively OR'ed at opto-isolator 158 such that when 20 either one is active, SCR 156 will be triggered and relay 152 will be energized to close a switch 162. Rectifiers 147-150 and capacitor form a filtered full-wave DC power supply for transfer relay 152. Fuse 146 protects the input supply against shorts within module 25 140 or its load. Power control module 140 can be used in system 10 to serve as ICM 12.

Figs. 8(a) through 8(e) show one way to package power control module 120 for commercial use. Fig. 8(a) shows an on/off switch just below an LED. Fig. 8(b) 30 shows an RJ-11 jack for input control signals. Fig. 8(c) shows a standard 120 VAC 3-wire grounded male power input plug. Figs. 8(d) and 8(e) are side views of opposite ends, with Fig. 8(d) showing a standard 120 VAC 3-wire grounded female power output plug. The power 35 control module thus packaged, is suitable for plugging into a standard duplex outlet in a home or office and

-22-

can be plugged in so that it will not cover the other plug in the duplex outlet.

Figs. 9(a) through 9(c) show the three major assemblies of power control module 120, for example, comprising a lower housing 202 (Fig. 9(a)), a circuit assembly 204 (Fig. 9(b)), and an upper housing 206 (Fig. 9(c)). A pair of spade plugs 208 serve as line in and neutral power input terminals. Terminal 122, LED 132, and relay 126 are mounted to assembly 204. When assembled, plugs 208 protrude through lower housing 202 and form a trio with ground lug 210. And, LED 132 protrudes through upper housing 206. A manual on/off switch 212 corresponds to that shown in Fig. 6 on the gate of triac 124. A power output molding slips over a connector 216 and corresponds to the line out and neutral power output. A single screw 218 is able to hold lower housing 202, circuit assembly 204, and an upper housing 206 together with the aid of interlocking lips on the upper and lower housings 206 and 202. This simple assembly can reduce manufacturing costs.

Higher Order Functions

Preferably, system 80 provides the ability to change how each of the attached power modules will turn on and off. Several characteristics of the attached computers and peripherals should go in to the choices on how each power module is to behave. Table I summarizes exemplary choices in a typical four power module system.

TABLE I

Status	Line 1	Line 2	Line 3	Line 4	comment
Wake-up State	off	off	off	off	on/off
Boot-Time	2	0	0	0	minutes
PC Settle-Time	15	0	0	0	seconds
Power-On Ring	1	0	0	0	rings
On-Hook Action	off	none	on	off	on/off/ none
Delay-to Action	30	0	0	0	seconds
Post Action State	off	user	on	off	on/off/ user
Answer-on Ring	1	0	0	0	rings
Operation Mode	passive or sentry				
Password	system = ? sentry = ?				
Modem Data Rate	38400; 19200; 9600; 4800; 2400; 1200				

In Table I, lines 1-4 correspond to four power modules (e.g., RPMs 81-84) connected to four appliances.

5 Line 1 controls a computer, such as computer 70. The wake-up state can be either set to on or off. If on, passwords are required for access by a caller to RCU 88 or computer 70 functions. If off, passwords are not required. Boot-time is a programmable delay that equals

10 or exceeds the time the computer needs to cold-boot after Line 1 turns it on. For example, an incoming call can be answered and put on hold for a period equal to the boot-time. Then the call is passed through to modem 84 for answering by computer 70. Some computer cold-

15 boot times, such as UNIX based systems, can exceed the time the telephone company will allow a phone to ring (typically four minutes). The boot-time helps deal with this situation. The PC settle-time is the time a system needs to wind down before a new command to power-up can

20 be entertained. In hard disk systems a few seconds are needed for the disks to stop spinning. In Table I, only

-24-

Line 1 has a time programmed in. The other lines do not have appliances that need to settle before being restarted. The number of rings that come in before a line is activated can be entered as the power-on ring.

5 The example in Table I shows power will be turned on to the computer after the very first ring. This will give the computer the most time to boot. More rings would be desirable if a user should be given a chance to answer the line first. It can also be a good idea to set this

10 count as high as ten, in order to keep the computer from coming on with just any random call that may come in, telemarketing and computer hackers being what they are. On-hook action is action that should occur after a caller has hung-up. In the case of a computer with a

15 FAX board that has just received a message, the FAX board will need time to process the message after the system goes on-hook. A delay parameter can be set for as long as five minutes. In another example, if a remote system and printer has received a long print-

20 file, book the computer and printer will need time after going on-hook to complete the print job. In Table I, the action Line 1 will take is to turn the power module off. Line 2 does nothing. Line 3 turns its power module on. And Line 4 turns its power module off. The

25 delay-to action for Line 1 is set to 30 seconds, the other lines act immediately. In other words, when the caller hangs-up and system 80 goes on-hook, the computer on Line 1 will be turned off after a delay of half a minute, Line 2 will stay as it is, Line 3 will go on

30 immediately, and Line 4 will go off immediately. The result is summarized as the post action state. Answer-on ring determines the number of rings that will occur before system 80 will go off-hook to answer a caller.

Table I could be used as a format for a computer

35 menu screen for a user sitting at computer 70 to enter in the above choices. The user can also enter passive

or sentry operation modes, the system (supervisor) and sentry level passwords, and the modem data rates to use. Passive mode means the detection of a ring will power on the remote host system. Sentry mode requires a password
5 be sent and validated before a call will be passed on to the computer.

Alternatively, a time-lock function can be added to provide additional security. Similar in concept to time locks on bank vaults, a time-lock on system 80, for
10 example, could prevent roaming hackers from randomly chancing on the system. A few users have been observed to be implementing the crudest of time-locks with simple timers meant to turn lamps on and off in a house at certain times to fool burglars into believing someone is
15 home. Preferably, a time-lock function implemented with system 80 is programmable and accessible to a user on a calling computer or, e.g., computer 70.

As a further alternative, distinctive dialing capability can also be implemented in RCU 88. Many
20 local phone companies are able to assign more than one number to a single subscriber line. Functioning like the old party-line, distinctive dialing is used on the single line to change the number and character of the rings to indicate which subscriber number is being
25 called. For example, one long ring followed by a short could be the first number. Two longs for the second, etc. RCU 88, in an alternative embodiment of the present invention, can be programmed to respond differently on the basis of distinctive dialing.

30 And as a still further alternative, "heartbeat" detection can be implemented in RCU 88 to cold-boot a computer, such as computer 70, if it should fail to periodically signal RCU 88 that it is alive and functioning.

35 A mail-box function can be implemented to allow a caller to leave messages in a mailbox. Alarm support

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preferably includes being able to detect alarm signals from the host system to then take appropriate action, such as a reboot, or place an alarm notice call. A print saver function powers off printers, such as

5 laserprinters which consume a lot of electricity, when not needed. Embedded strings can be useful to reawaken an RCU to gain access to a power control module. Programmatic power control would allow a computer to send signals to control its own power and that of the

10 peripherals attached to it. For example, many systems are left unattended at night broadcasting lists of FAX letters or running backups after-hours. Once an unattended computer has completed its jobs, it can

signal itself through system 80, for example, to power

15 down. This reduces power waste, a risk of unauthorized access, and a risk of electrical damage from lightning and voltage surges.

Although the present invention has been described in terms of the presently this embodiments, it is to be

20 understood that the disclosure is not to be interpreted as limiting. Various alterations and modifications will no doubt become apparent to those skilled in the art after having read the above disclosure. Accordingly, it is intended that the appended claims be interpreted as

25 covering all alterations and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

IN THE CLAIMS

1. A power management system, comprising:
at least one power control module (PCM) in a
5 compact housing for directly plugging into an AC wall
outlet, the PCM having a jack to receive a control
signal; and

a response control unit (RCU) having at least
control signal output for coupling with said control
10 signal jack, a telephone company subscriber line
interface and jack, a serial communications interface
for a computer system, a serial communications interface
for a modem, and a subscriber line interface for said
modem.

15 2. The system of claim 1, wherein:

the PCMs have switch means for manually
controlling within said housing the coupling of input AC
power to an output plug.

20 3. The system of claim 1, further comprising:

programmable means for accepting, storing, and
using a plurality of parameters from a user that control
how the PCMs and RCU interact in response to a call
25 received on said telephone company subscriber line
interface.

4. The system of claim 3, wherein:

the programmable means has provisions for an
30 independent wake-up parameter for each PCM such that an
incoming call can allow a ring condition on said
telephone company subscriber line interface to turn on a
respective PCM.

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5. The system of claim 3, wherein:

the programmable means has provisions for an independent boot-time parameter for each PCM such that an incoming call on said telephone company subscriber
5 line interface can be put on hold for a predetermined time after turning on a respective PCM before being passed through to said modem subscriber line interface.

6. The system of claim 3, wherein:

10 the programmable means has provisions for an independent PC settle-time parameter for each PCM such that a programmable period related to said parameters must elapse after an incoming call on said telephone company subscriber line interface goes on-hook before
15 the respective PCM can be commanded to turn back on.

7. The system of claim 3, wherein:

the programmable means has provisions for an independent on-hook action parameter for each PCM such
20 that once an incoming call on said telephone company subscriber line interface goes back on-hook the respective PCMs will turn-on, turn-off, or stay as they are.

25 8. The system of claim 7, wherein:

the programmable means has provisions for an independent delay-to action parameter for each PCM such that said on-hook action will be delayed for a period of time after said incoming call goes back on-hook.

30

9. The system of claim 3, wherein:

the programmable means has provisions for an answer on ring parameter such that an incoming call on said telephone company subscriber line interface will be
35 allowed to ring a programmable number of times before the RCU goes off-hook to answer said call.

10. The system of claim 3, wherein:

the programmable means has means for monitoring said computer system serial communications interface such that if a computer system with its power controlled by one of the PCMs should fail to periodically send a heartbeat signal, the respective PCM will be commanded to turn power off and then back on so as to cause said computer system to reboot.

10

11. A telephone signal activated response control unit (RCU), comprising:

ring detector means for sensing signals on a telephone line;

15

modem interface means for making an attached modem coupled to said telephone line answer an incoming telephone call and to remain in a command mode;

dialogue means for communicating with a calling computer that initiated said incoming telephone call;

20

validation means for analyzing the authority of said calling computer to access the RCU;

man-machine interface means for interpreting and executing commands entered by a user from said calling computer; and

25

control means for responding to said user commands by activating and managing external appliances.

12. The RCU of claim 11, wherein:

30

the control means has a plurality of independent channels for signalling respective remote power modules to turn AC power on or off.

-30-

13. A power management system, comprising:

a remote power control module (RPCM) with a jack to receive a control signal line, the RPCM having semiconductor means for controlling a relay for
5 switching AC power on and off to a controlled appliance, said semiconductor means such that a low voltage DC signal on said control line can operate said relay; and
a response control unit (RCU) having at least one control signal output for coupling with said control
10 signal jack, a telephone company subscriber line interface and jack, a serial communications interface for a computer system, a serial communications interface for a modem, a subscriber line interface for said modem, and a microcontroller coupled to all said jacks and
15 interfaces such that a caller on said subscriber line interface can be answered, qualified, and allowed to cause said controlled appliance to be turned on and off.

14. The system of claim 13, wherein:

20 the RCU further comprises a DTMF decoder coupled to said microcontroller such that DTMF tones may be used to effectuate said manipulation of power to said controlled appliance.

14. The system of claim 13, wherein:

25 the RCU further comprises modem control means for managing an external modem connected to said modem interface and coupled to said microcontroller such that serial data communication with said caller may be used
30 to effectuate said manipulation of power to said controlled appliance.

15. A remote power control module, comprising:

a lower housing made of an insulating material
35 with slots for an AC power input plug to pass through and a locking lip;

a circuit assembly having an AC power input plug positioned to pass through said slots in the lower housing, the assembly further having means for receiving a control signal and a relay controlled by said control
5 signal, said relay able to couple power from said power input plug to a power output plug, the assembly having an LED to indicate the state of said relay; and

an upper housing made of an insulating material such that it mates with said locking lip and
10 encloses the circuit assembly with the aid of a single screw, the upper housing having an opening that allows a user to view said LED.

16. A computer system risk exposure reduction
15 apparatus, comprising:

means to prevent a modem attached to a local computer system from responding to a calling computer based on at least one parameter that is programmable by at least one of the local computer and said calling
20 computer; and

means to control power to said local computer based on at least one of the following: the number of rings, the time-of-day, a password,

25 17. A system for re-starting a mission critical device located at a remote site that is accessible by telephone, the system comprising:

status means for communicating with a mission critical device such that at least one condition of said
30 device can be determined;

telephone interface means for responding to a telephone caller; and

switching means for allowing said telephone caller to power on and off said mission critical device
35 based on data received from the status means.

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18. The system of claim 17, further comprising:
crash detecting means for determining whether
or not said mission critical device is still alive as
evidenced by a periodic heartbeat signal received over
5 the status means.

AMENDED CLAIMS

[received by the International Bureau on 21 May 1992 (21.05.92);
second claim 14 cancelled; other claims unchanged (1 page)]

13. A power management system, comprising:
a remote power control module (RPCM) with a
jack to receive a control signal line, the RPCM having
semiconductor means for controlling a relay for
5 switching AC power on and off to a controlled appliance,
said semiconductor means such that a low voltage DC
signal on said control line can operate said relay; and
a response control unit (RCU) having at least
one control signal output for coupling with said control
10 signal jack, a telephone company subscriber line
interface and jack, a serial communications interface
for a computer system, a serial communications interface
for a modem, a subscriber line interface for said modem,
and a microcontroller coupled to all said jacks and
15 interfaces such that a caller on said subscriber line
interface can be answered, qualified, and allowed to
cause said controlled appliance to be turned on and off.

14. The system of claim 13, wherein:
20 the RCU further comprises a DTMF decoder
coupled to said microcontroller such that DTMF tones may
be used to effectuate said manipulation of power to said
controlled appliance.

25

30

15. A remote power control module, comprising:
a lower housing made of an insulating material
with slots for an AC power input plug to pass through
35 and a locking lip;

STATEMENT UNDER ARTICLE 19

REMARKS

The revised abstract prepared by the ISA/US is not objected to by this applicant and the time for commenting on the revised abstract has been intentionally allowed to expire.

The Invitation to Request Rectification was directed toward a problem with the numbering of the claims. Rather than responding under Article 14(1)(b) to amend the claims, this applicant is now responding under Article 19(1) and Rule 46.1 to correct the claim numbering problem by the submission of a replacement page 30 that eliminates the second of the claims that were numbered "30".

Conclusion

Accordingly, in view of the preceding amendments and remarks, it is respectfully submitted that the pending application, with pending Claims 1-18 is in proper condition for further international processing and such action is respectfully requested.

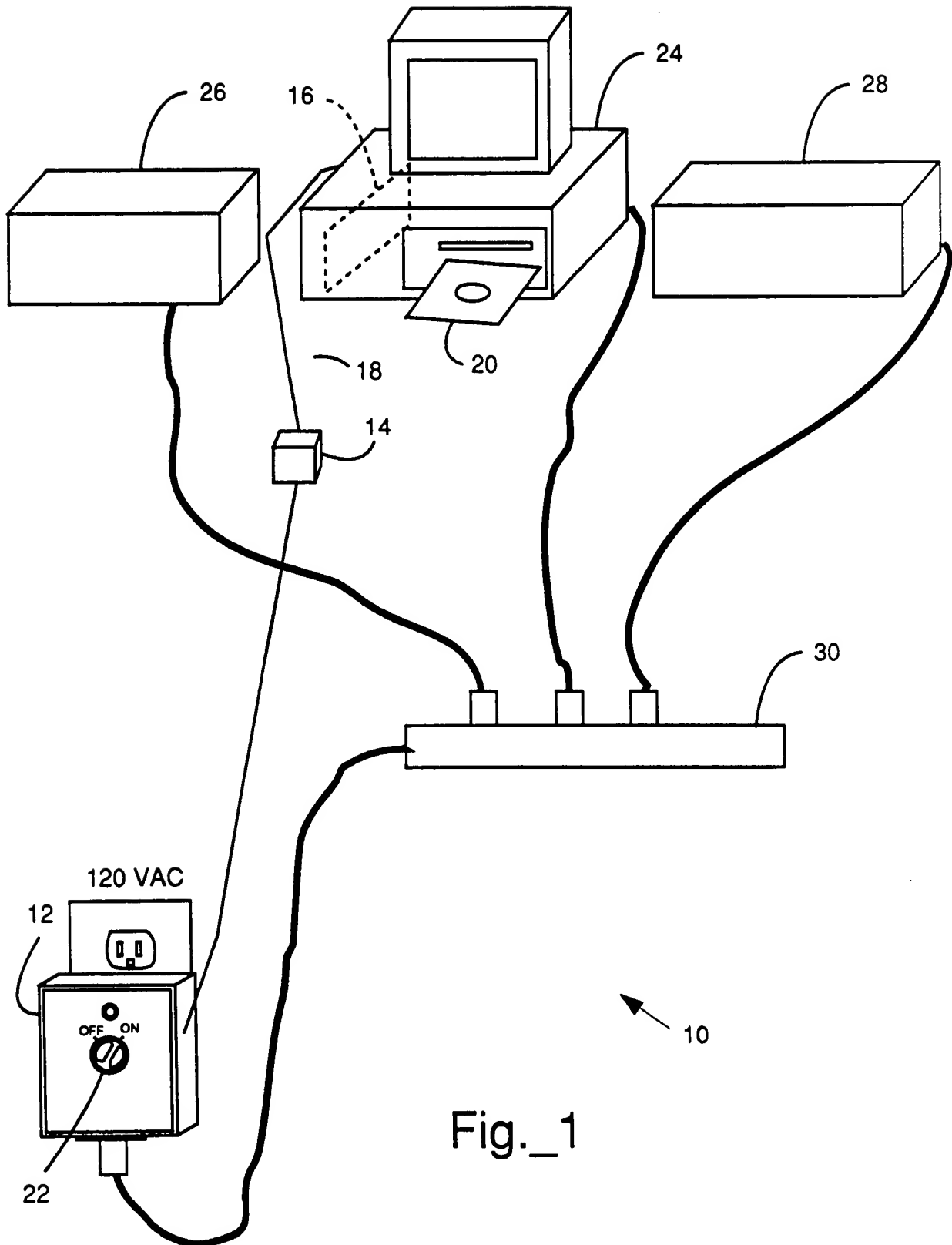


Fig._1

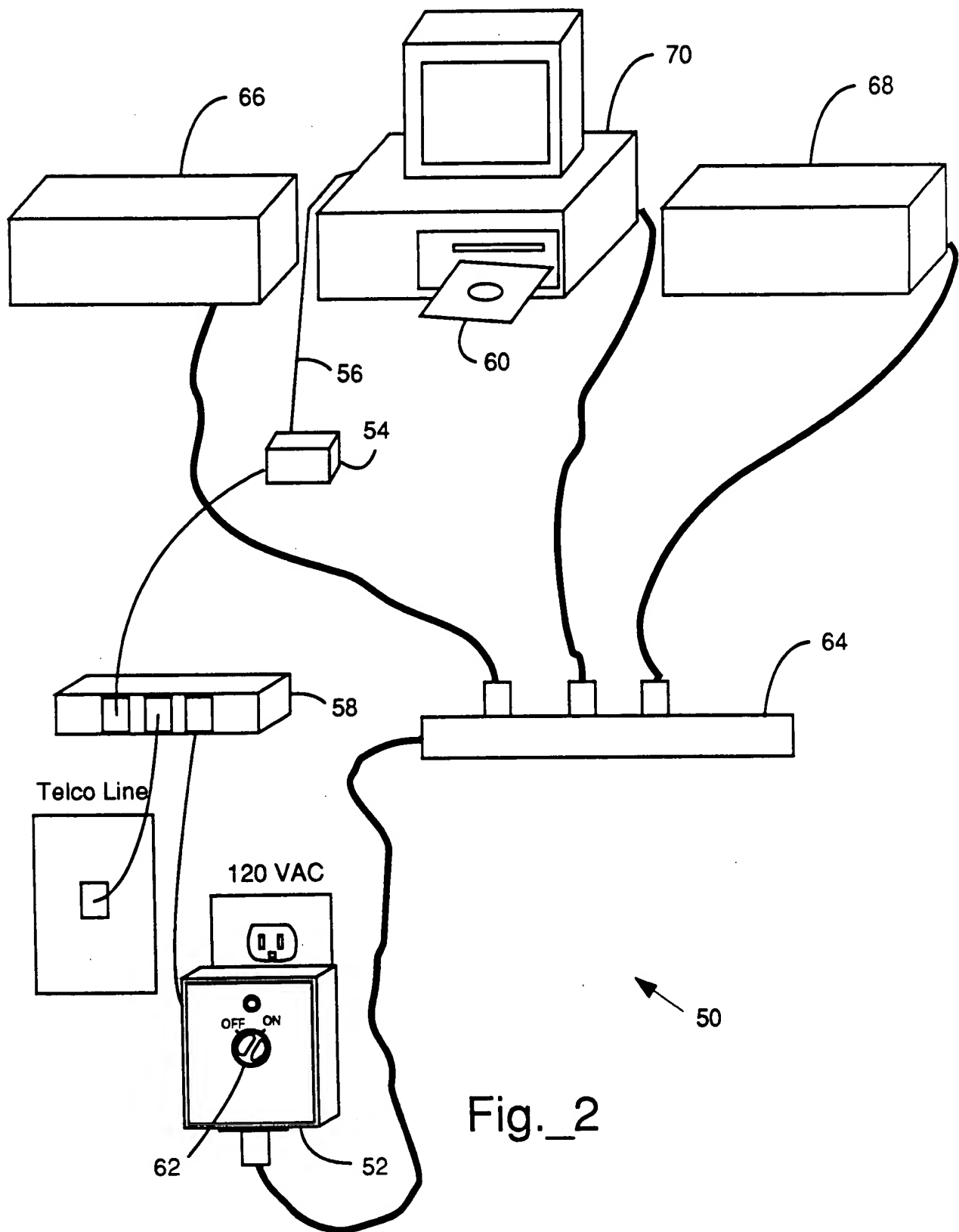


Fig._2

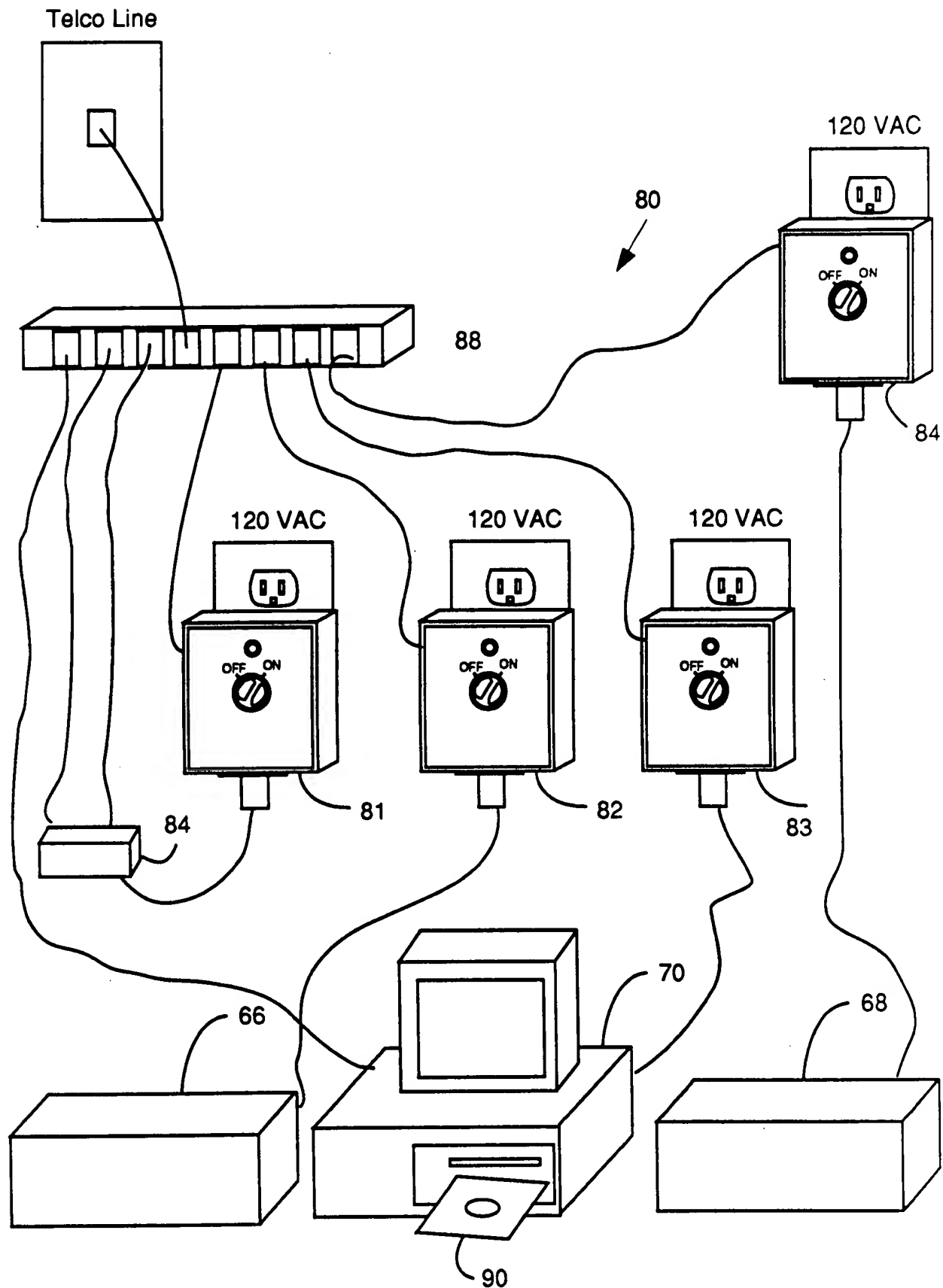


Fig._3

Fig. 4

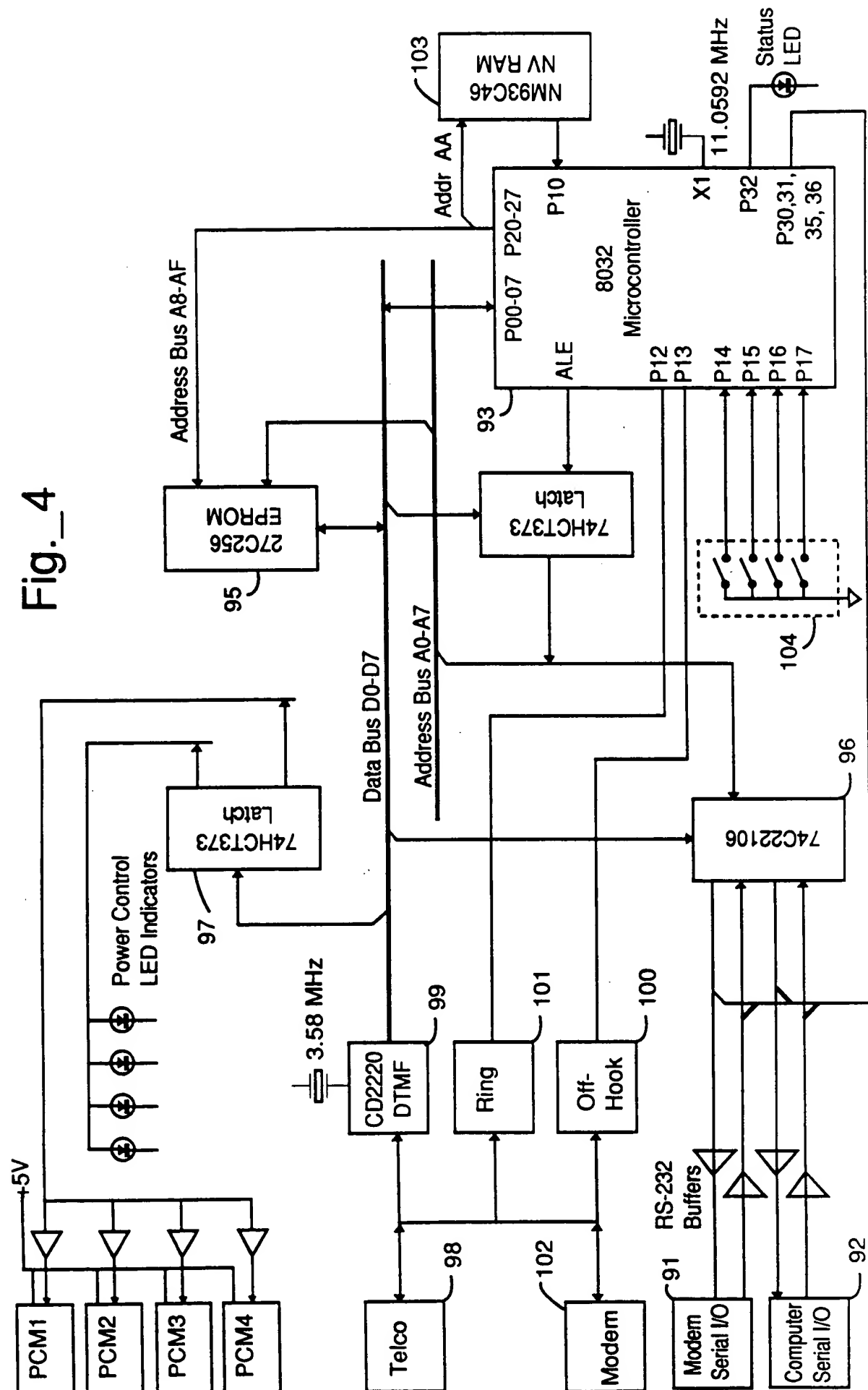


Fig._5

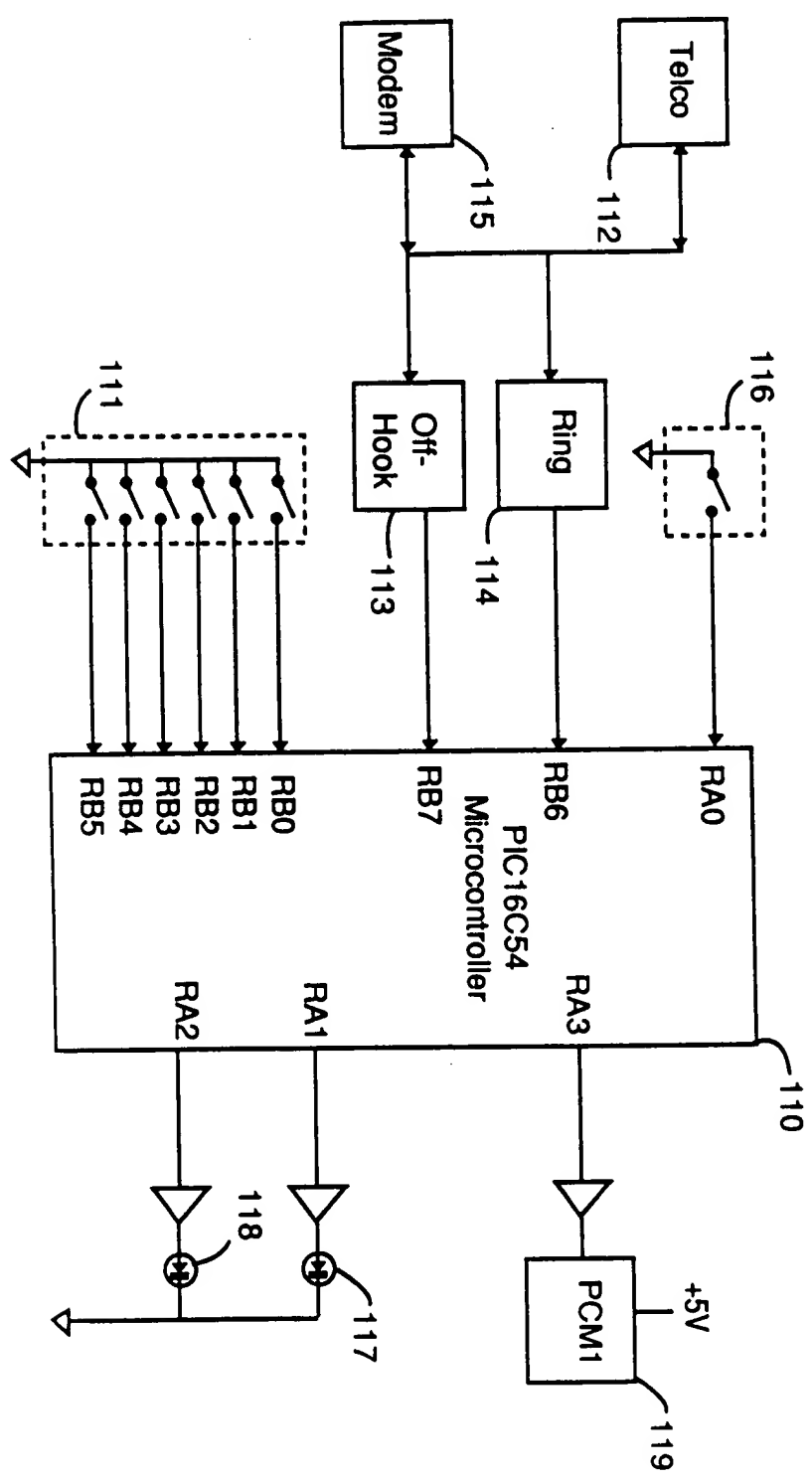
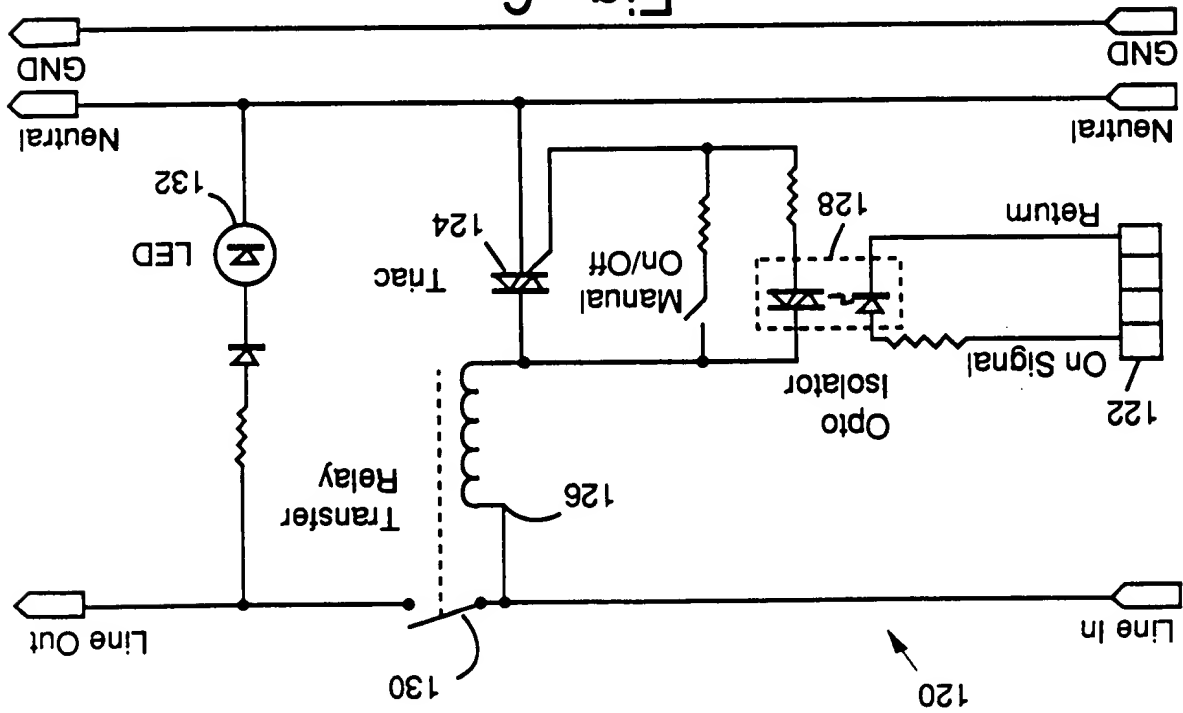


Fig. 6



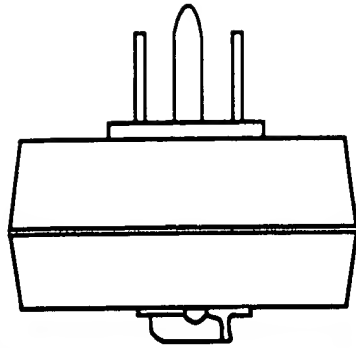


Fig._8(e)

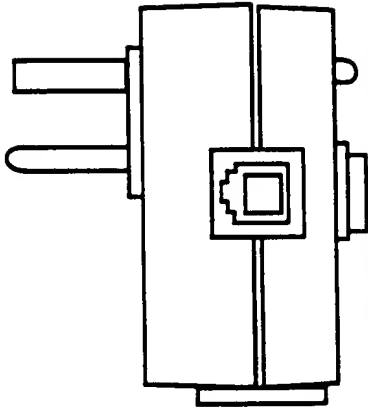


Fig._8(b)

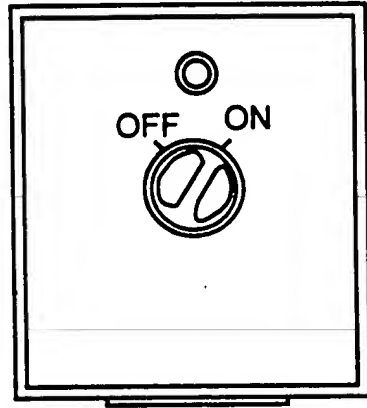


Fig._8(a)

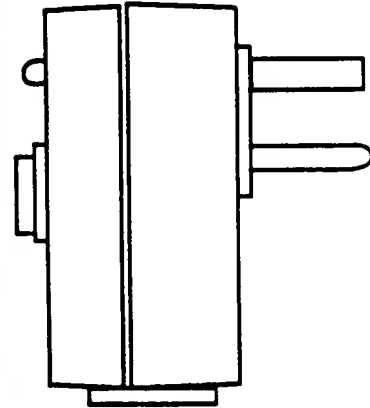


Fig._8(c)

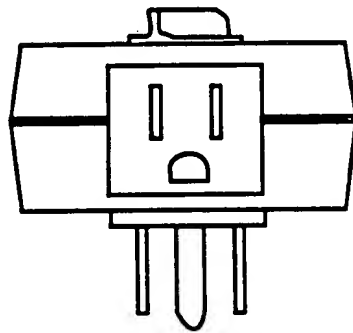


Fig._8(d)

Fig._9(a)

Fig._9(c)

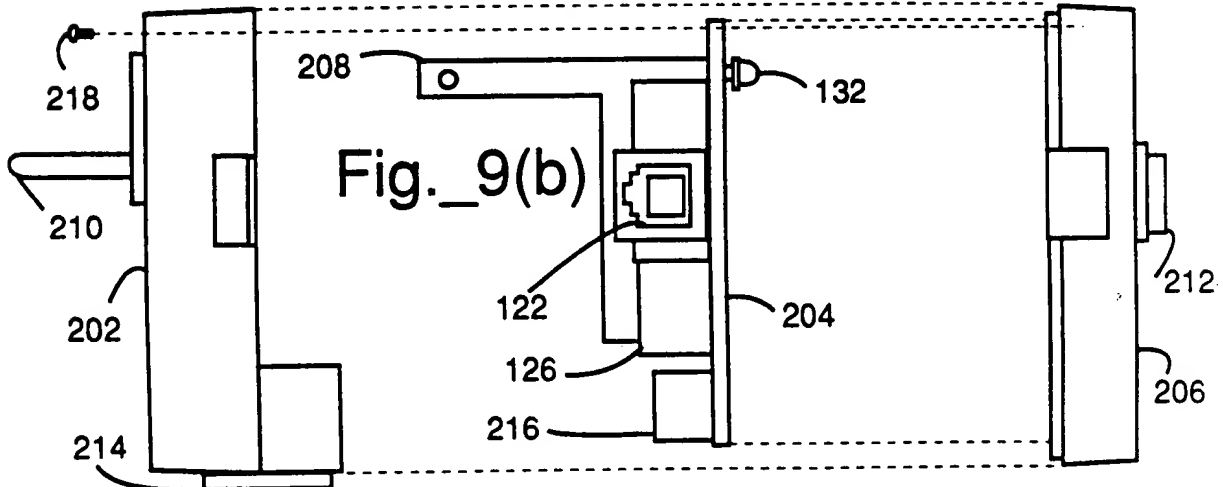


Fig._9(b)

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/08543

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): H04M 11/00; U.S. CL.: 379/95

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

U.S. CL. 379/95, 93, 96-98, 102, 104, 105;
340/310R, 310A

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US, A, 4,647,721 (BUSAM ET. AL.) 03 MARCH 1987 See Figure 1.	1-18
Y	US, A, 4,686,526 (GRITZO) 11 AUGUST 1987 See Abstract.	10, 18
Y	US, A, 4,701,946 (OLIVA ET. AL.) 20 OCTOBER 1987 See Abstract, Fig. 3.	1-18
Y	US, A, 4,907,254 (SUZUKI ET. AL.) 06 MARCH 1990	1-18
Y	US, A, 4,922,450 (ROSE ET. AL.) 01 MAY 1990 See Abstract, Figs. 1-8.	1-18
Y	US, A, 5,003,578 (LIN) 26 MARCH 1991 See Abstract, Figs. 2-5	15
Y	US, A, 5,051,720 (KITIRITSUNETORN) 24 SEPTEMBER 1991 See Abstract, Figs. 1-4.	1-18

^{*} Special categories of cited documents: ¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Δ" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

13 FEBRUARY 1992

International Searching Authority

ISA/US

Date of Mailing of this International Search Report

09 MAR 1992

Signature of Authorized Officer

WING FU CHAN